AESI
Arrow Engineering Services, Inc.
CIVIL ENGINEERING ▪ SURVEYING ▪ SOILS ▪ MAPPING/GIS

PRELIMINARY HYDROLOGY STUDY

FOR

HESPERIA WEST

SOLAR PV PROJECT

LOCATED AT

The Northeast corner of the intersection of

Fuente Avenue and El Centro Road

in Hesperia, California

APN 0405-372-40

Approximately 20 Acres

REGISTERED PROFESSIONAL ENGINEER
BRIAN D. GLIDDEN
48287
Expires 6/30/14
CIVIL
STATE OF CALIFORNIA

Brian D. Glidden

42140 Tenth Street West, Lancaster CA 93534 661-940-0043 661-949-9775 Fax:

12-6148 11/29/2012

DRAINAGE STUDY

Introduction

This study was prepared for the potential development of a 20 acre parcel located in unincorporated area of San Bernardino County southwest of the City of Hesperia. The property is rectangular in shape with the approximate dimensions of 660 x 1320 feet. The surrounding streets are Fuente Avenue to the west, Fir Street to the north, Bandicoot Trail to the east, and El Centro Road to the south, all unimproved. The proposed development consists of fixed-tilt, ground mounted photovoltaic solar panel arrays. Concrete equipment pads will be provided for the electrical gear. A reduced copy of the proposed site plan can be seen in Figure 1. Site APN is: 0405-372-40

Site Latitude, Longitude

34.3914º , - 117.3617º

Purpose & Scope

The purpose of this study was to provide a preliminary drainage study to comply with submittal requirements of San Bernardino County for CUP purposes.

The study is based on the Hydrology Manual of San Bernardino County and the April 2010 Addendum to the Hydrology Manual. The preliminary study will determine the tributary area for drainage affecting the site and make an estimate for the quantity of water runoff for the 100 year event.

General

The site is currently vacant with amounts of sage brush and native grasses indicative of the Mojave Desert. The site contains two or three trees from the cedar species and a few Joshua trees. The site generally drains to the North East at approximately 2%. A shallow drainage path traverses the site from South to North East. According to FEMA the property lies in Flood Zone “D” on FIRM 06071C6490H. The parcel is not located in a special flood hazard zone. Zone "D" indicates "Flood hazards undetermined, but possible".

Drainage across the site is currently characterized by sheet flow. Storm water leaving the site flows northerly and easterly along unimproved streets to eventually find its way under the California Aqueduct and ultimately the Mojave River. The surficial soils appear to be a silty, fine to coarse, medium brown sand.

Fuente Avenue, on the west side of the site, appears to carry the major portion of upstream storm flows based on observed erosion. A much smaller tributary area of storm water south of El Centro Road appears to slowly sheet flow across El Centro Road near the easement south of the subject site then splits with some water being naturally diverted easterly along El Centro Road and a portion flows northeasterly through the site.

The site is located within the Hesperia Master Plan of Drainage (HMPD). The HMPD shows a planned drainage facility with a north/south alignment in the middle of the parcel. This facility is identified as H-06 and is described as an open trapezoidal earthen channel approximately 7 feet deep, with a 12 foot wide bottom and 3:1 side slopes. The approximate right-of-way width for this facility is 94 feet. There are two existing unimproved offsite drainage easements adjacent to the site. One is located near the midsection of the site south of El Centro Road aligned in a north-south direction and is 84' wide. The other is located east of Bandicoot Trail approximately half the distance between Fir Street and El Centro Road aligned in a northeast direction and is 125' wide. It is not known when or if these easements will be utilized in the future by the County for the masterplanned improvements. We have proposed a connecting easement through the site that runs parallel to El Centro Road then turns to the northeast to Bandicoot Trail (see the site plan for the proposed location of easement). Per a telephone discussion with Anthony Pham with San Bernardino County, we agreed upon an onsite easement as shown on the site plans consisting of a 100' wide segment parallel with El Centro Road connecting to the existing easement south of our site, then turning northeast and widening to 125' in order to match the extended alignment of the Northeasterly offsite easement.

This H-06 drainage is planned to empty to a future drainage basin called the "Bandicoot" Basin near the California Aqueduct north of Mesquite Road. These drainage flows that do not percolate into the soil or evaporate will eventually empty into the Mojave River. This site is also subject to a local Storm Water Management Plan (SWMP) covering the Mojave River Watershed.

The site is proposed for development as a photovoltaic solar farm for electrical energy generation. The solar panels will be elevated by column structures supported by the native soil. Using this type of construction minimizes the need for site grading. Elevation of the solar arrays will allow for ease of maintenance as well as relatively unimpeded surface drainage.

The project proposes no habitable structures.

Analysis

The site watershed is approximately 805.4 acres in size and extends for approximately 3.8 miles southwesterly. Drainage approaches the site from the Southwest and appears to cause erosion damage in Fuente Avenue on the west side of the site. This is evidenced by visual assessments at the site.

The watershed boundaries were determined through the use of a topographic map of the area (See Figure 2, Hydrology Map). The soils group was determined by the use of the Natural Resources Conservation Service (NRCS) website referred to in the Addendum to the Hydrology Manual. From this source site soils were determined to be CA671. This corresponds to a Hydrologic Soils Group B soil for the purposes of data input into the computer program for determining estimated runoff amounts. Further search on the website indicates the entire watershed is the same soil designation.

Since the upstream watershed area is sparsely populated, the imperviousness values are extremely low for both the pre and post developed conditions. To look at worst case scenario, only the post developed offsite flows were calculated. Land use designations for the watershed are 774.4 acres of RL (Rural Living) and approximately 31 acres of CN (Neighborhood Commercial). Land use designations were determined from the County of San Bernardino Land Use zoning maps available from the County website. For routing analysis the study assumed a very conservative Manning's "n" value of 0.025 considering that in the future development roads will be developed. All roads in the upstream watershed appear to be mostly unimproved.

Since the watershed drainage slope was fairly uniform, only one type of soil was encountered, and only two land use designations were found, the tributary areas were broken down by the 100 acre limit of the hydrology method. The land use condition of 31 acres of Neighborhood Commercial property was proportionalized in the data input. In the analysis a 0.4 dwelling/acre approximation (90% Perviousness) was used for the RL area. Ten percent perviousness was used for the CN area. Calculations for the weighted average pervious percent are provided in the appendix. The resulting subarea map can be seen in Figure 2. The node numbers were organized into 100 series values to aid in the separation of areas. This figure also contains the values for area, elevation, travel length, and node numbers.

The values obtained for each subarea were then used in the flood routing analysis. The analysis was computed by the rational method using software prepared by AES (Advanced Engineering Software) Ver. 16.0. The one hour rainfall depth for the 100-year, 60 minute, event was determined from the point frequency estimates within NOAA Atlas 14 to be 1.32 inches (see Figure 4). The analysis was performed using Antecedent Moisture Condition (AMC) III. This value was obtained by determining the

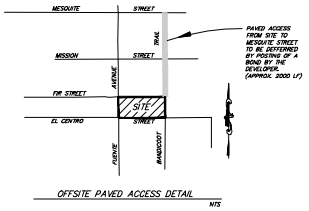
site location on the map provided on the county website inside the 2010 Addendum to the Hydrology Manual. The detailed calculations and results can be sound in the detailed calculations in the appendix. The results show the 100 year event flows are estimated to be 506.39 CFS at node 112.

The storm flows will sheet across the property towards the northeast and continue as it does currently. Since minimum grading is proposed for the site and no changes in the imperviousness are expected no mitigation measures other than providing drainage easements for future drainage improvements are proposed.

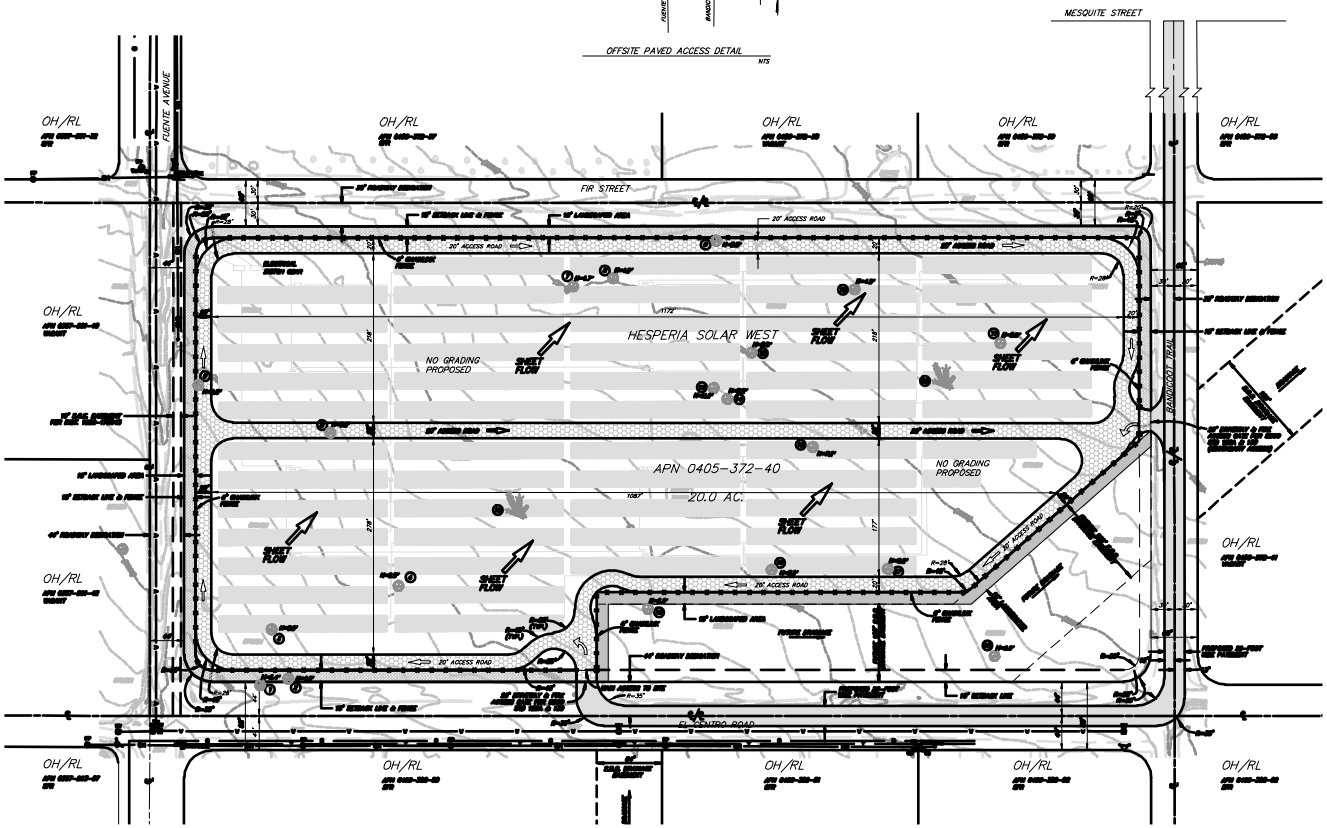
Conclusions and Recommendations

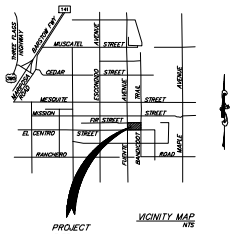
The nature of the construction of this proposed solar farm project will have no appreciable effects to the current runoff rates, drainage patterns, or quantity of runoff. At this time only drainage easements are proposed through the site to connect the two existing adjacent offsite easements. Due to sheet flow drainage conditions across the site we recommend that the photo voltaic modules be placed at least 2 feet above existing ground.

FOR OFFICIAL USE ONLY



OFFSITE PAVED ACCESS DETAIL
NTS





VICINITY MAP
NTS

BENCHMARK

NATIONAL GEODETIC SURVEY BENCH MARK DESIGNATION J 1047, PID EY4434, BEING A BRASS DISC SET IN TOP OF CONCRETE MONUMENT 41 N.E. CORNER OF MUSCATEL STREET AND MAPLE STREET.

ELEV.: 3415.30 (NAVD88)

BASIS OF BEARINGS

PARCEL MAP NO. 10577 IN THE COUNTY OF SAN BERNARDINO, CALIFORNIA, FILED SEPTEMBER 29, 1998 IN BOOK 131, PAGES 66 AND 67 OF PARCEL MAPS IN THE OFFICE OF THE RECORDER FOR SAID COUNTY WAS USED AS THE BASIS OF THE BEARINGS SHOWN HEREON.

LEGAL DESCRIPTION

THE SOUTH HALF OF THE SOUTHWEST QUARTER AND THE NORTHWEST QUARTER OF SECTION 36, TOWNSHIP 4 NORTH, RANGE 5 WEST, SAN BERNARDINO MERIDIAN, IN THE COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA.
APN: 0405-372-40 (620 ACRES)

BOUNDARY NOTE

A PRELIMINARY BOUNDARY ANALYSIS WAS PERFORMED BY AES FOR THE PREPARATION OF THIS SITE PLAN. THE BOUNDARY DIMENSIONS SHOWN HEREON ARE CALCULATED FROM THE SURVEY AND PARCEL MAP NO. 10577, RECORDED IN PARCEL MAP BOOK 131, PAGES 66 AND 67.

UTILITIES

GAS:
SOUTHWEST GAS CORPORATION
13471 MARIPOSA ROAD
VICTORVILLE, CA 92395-5396
PH: 760-241-3321

WATER:
SAN BERNARDINO COUNTY
COMMUNITY SERVICES AREA (CSA) 70 ZONE J
17830 REDWOOD BLVD., BUILDING D, SUITE 6
VICTORVILLE, CA 92395
PH: 760-955-3885

PHONE:
VERIZON
TELEPHONE & CABLE
16071 MOJAVE DRIVE, BLDG A
VICTORVILLE, CA 92395
PH: 760-245-0685

CABLE:
NO CABLE AVAILABLE IN THIS AREA

ELECTRIC:
SOUTHERN CALIFORNIA EDISON
PH: 800-611-1911

GRAPHIC SCALE

(IN FEET)
1 inch = 60 ft.

ASSESSOR PARCEL NUMBER: 0405-372-40

APPLICATION TYPE AND PROPOSED LANDUSE

CUP FOR 2.7MW SOLAR FACILITY

APPLICANT:

SYCAMORE PHYSICIANS PARTNERS LLC
5174 CLE ROAD
NORTH RIDGEVILLE, OH 44039
PHONE: 440-391-6733

APPLICANT REPRESENTATIVE:

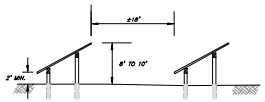
SYCAMORE PHYSICIANS PARTNERS LLC
CHRISTINE DUTTA
PHONE: 330-881-1004

RECORDED PROPERTY OWNER(S):
CORNUS HESPERIA WEST 1, LLC

PLAN PREPARED:
ARROW ENGINEERING SERVICES INC.
42740 10TH STREET WEST
LANCASTER, CA. 93534

PREPARATION DATE: 5/2/2012

REVISION DATE: 11/30/2012



SOLAR ARRAY SIDE ELEVATION
NTS

SWITCHGEAR AND TRANSFORMERS PAD
NTS

ACCESS ROAD DETAIL
NTS

REGULATED DESERT NATIVE PLANT TABLE

P = PROTECT IN PLACE R = REMOVE T = TRANSPLANT*

(1) – P	(6) – T	(11) – T	(16) – T
(2) – P	(7) – T	(12) – P	(17) – T
(3) – T	(8) – T	(13) – T	(18) – P
(4) – T	(9) – T	(14) – T	(19) – T
(5) – T	(10) – T	(15) – T	(20) – T

* ALL JOSHUA TREES AND SHORT-JOINT BEAVERTAIL CACTI TO BE TRANSPLANTED WILL BE RELOCATED TO THE TO-FOOT LANDSCAPE STRIP ALONG NORTH, WEST AND EAST PERIMETERS OF PROJECT.

LEGEND

EXISTING FIRE HYDRANT	X	PROPOSED 6-FOOT HIGH CHAIN-LINK FENCE
EXISTING UTILITY POLE	G	EXISTING GAS LINE
EXISTING UTILITY GUY	W	EXISTING WATER LINE
EXISTING WATER METER	OH	EXISTING OVERHEAD UTILITY LINE
EXISTING WATER VALVE	T	EXISTING TELEPHONE LINE
EXISTING JOSHUA TREE WITH HEIGHT AS NOTED		ACCESS ROADWAY - CRUSHED ROCK ON COMPACTED NATIVE MATERIAL
EXISTING SHORT-JOINT BEAVER TAIL CACTUS		LANDSCAPED AREA
REGULATED DESERT NATIVE PLANT TABLE NUMBER DESIGNATION - SEE TABLE ABOVE		PAVEMENT AREA
		ONE WAY TRAFFIC DIRECTION

FIGURE 1

S. 1/2, SW 1/4, NW 1/4, SEC. 36, T4N, R5W, S.B.M.

SOLAR EQUIPMENT NOTE

THE QUANTITY AND PLACEMENT OF PV PANELS AND EQUIPMENT IS APPROXIMATE.

ROADWAY NOTES

1.) ALL THE ROADS SURROUNDING THIS SITE ARE DIRT. CURB, GUTTER AND SIDEWALK DO NOT EXIST.

2.) THE CLOSEST PAVED STREET IS ±2000' NORTH OF THE SITE, WHICH IS MESQUITE STREET.

UNDERGROUND SERVICE ALERT

CALL TOLL FREE:
1-800-227-2600

TWO WORKING DAYS BEFORE YOU DIG

ARROW ENGINEERING SERVICES
LANCASTER OFFICE:
42740 10TH STREET WEST
LANCASTER, CA 93534
PHONE: (661) 940-0043

AESI
LAS VEGAS OFFICE:
3795 E. HOWARD DR. #103
LAS VEGAS, NV 89104
PHONE: (702) 221-0626

SIGNATURE

DATE

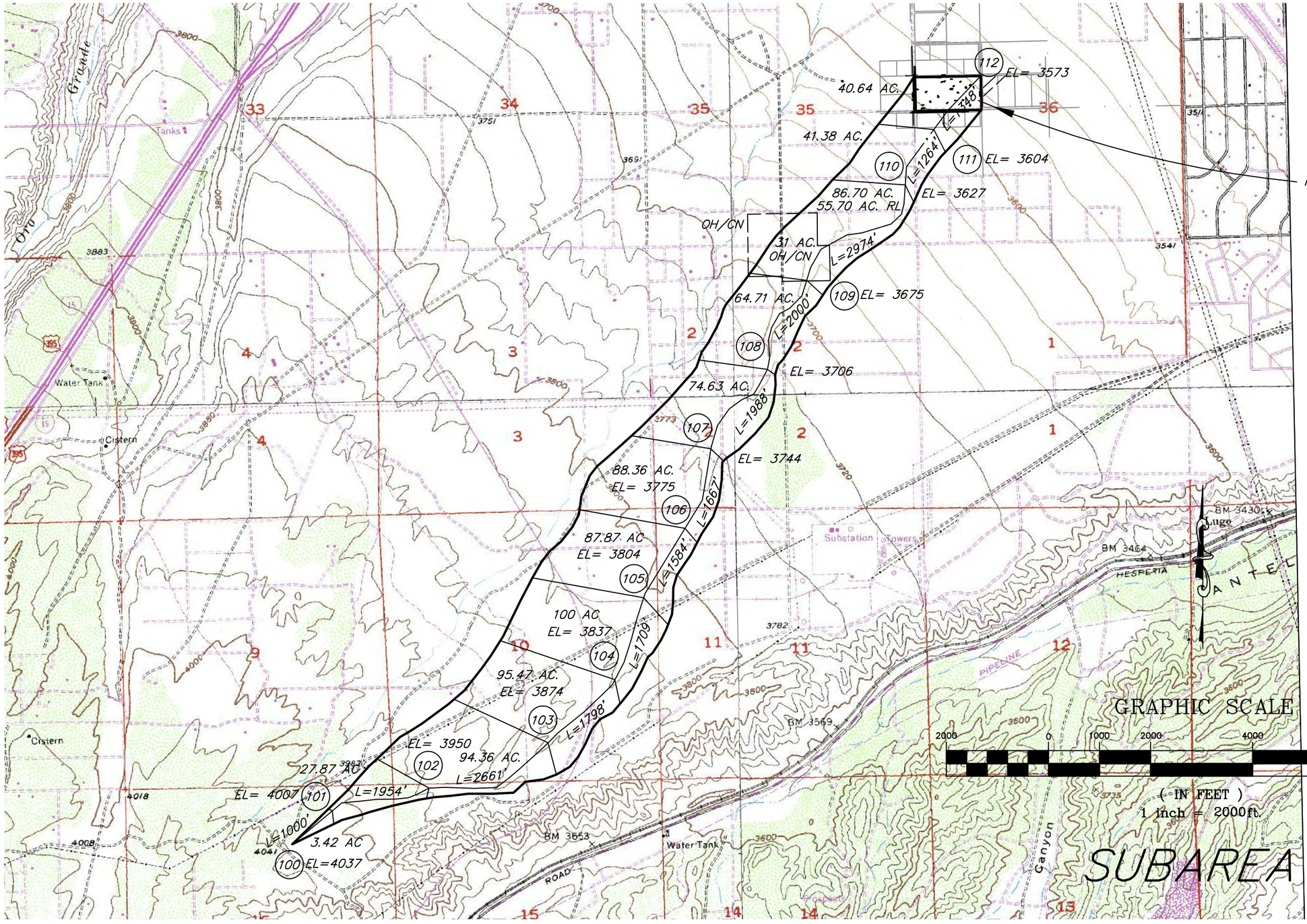
DRAWING NAME: 1261418_SITEPLAN

PLOT DATED: 11/30/2012

REVISION BLOCK			PLAN CHK	CITY ENGR
REV#	APPR	DATE	REVISION DESCRIPTION	APPR	APPR	DATE
△						

PLOT PLAN WITH PV
CUP FOR
2.7 MW SOLAR PV ELECTRIC FACILITY
HESPERIA WEST
APN 0405-372-40
SAN BERNARDINO COUNTY, CA

SHEET 1 OF 1 SHT


112
EL= 3573
40.64 AC.
L=748'
41.38 AC.
110
L=1264'
111
EL= 3604
86.70 AC.
55.70 AC. RL
EL= 3627
OH/CN
31 AC.
OH/CN
L=2974'
64.71 AC.
109
EL= 3675
L=2000'
108
EL= 3706
74.63 AC.
L=1988'
107
EL= 3744
88.36 AC.
EL= 3775
106
L=1667'
87.87 AC
EL= 3804
105
L=1584'
100 AC
EL= 3837
104
L=1709'
95.47 AC.
EL= 3874
103
L=1798'
EL= 3950
102
94.36 AC.
L=2661'
27.87 AC.
EL= 4007
101
L=1954'
L=1000'
3.42 AC
100
EL=4037
PROPOSED SOLAR PROJECT
SUBAREA ZONING = RL
(EXCEPT AS NOTED)
GRAPHIC SCALE
2000 0 1000 2000 4000 8000
(IN FEET)
1 inch = 2000 ft.
SUBAREA MAP
FIGURE
2

APPENDIX

Attachment - Attachment A Land Use Zoning District Map

Attachment - Detailed Calculations Watershed 100-116 (10 pages)

Attachment - Summary Watershed 100-112 (2 pages)

Attachment - Web Soil Survey, webpage printout (NRCS) (2 pages)

Attachment - Point Precipitation Frequency Estimates (4 pages) (NOAA Atlas 14)

Attachment - Hesperia Master Plan of Drainage Plan Profile Line H-06 (3 pages)

Attachment - Calculation for weighted average land use pervious percent between nodes 109 and 110

Attachment - Figure ADD-1 AMC areas (2 pages)

Attachment - Bandicoot - Node 112 Chanel Sizing

Attachment - Photos (3 pages)

ATTACHMENT A
LAND USE ZONING DISTRICT MAP

SITE

OH/RL

OH/IN

OH/RL

T4N T4N
T3N T3N

OH/CN

OH/CN

OH/CG

OH/FW

OH/FW

OH/FW

OH/RL

OH/RL

OH/IN

R5W
R5W

OH/RL

OH/RL

OH/IN

OH/RL

OH/IC

OH/RL

OH/RL

OH/RS-1

OH/RL

OH/RL

OH/IN

OH/RS-1

OH/RS-1

OH/IN

OH/RS-1

OH/IN

OH/IN

RS-1

RL-10-AP

RS-14M

RS-14M

IC

RS

RL-10-AP

IN

ESPERIA

Oro Grande

Canyon

N. T. S.

AES

12-6148

Detailed Calculations Watershed 100-112

```
**************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
         (Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
        (c) Copyright 1983-2009 Advanced Engineering Software (aes)
            Ver. 16.0  Release Date: 04/01/2009  License ID 1276

                            Analysis prepared by:

                              Arrow Engineering
                            42138 10th Street West
                             Lancaster CA, 93534
                                (661) 949-2525

 ************************* DESCRIPTION OF STUDY *************************
* ARROW ENGINEERING SERVICES                  JOB 12-6148                *
* HESPERIA WEST (PV SOLAR PROJECT) 20 ACRES APN 0405-372-40              *
* HYDROLOGY FLOWS FOR NODES 100-112                                      *
 ************************************************************************

  FILE NAME: 6148HYD3.DAT
  TIME/DATE OF STUDY: 14:36 11/30/2012
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  24.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.7000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.3200

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150
  2   40.0     30.0    0.020/0.020/0.020   0.67    2.00 0.0313 0.167 0.0250

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  1.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint = 10.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

**************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==========================================================================
```

```
 INITIAL SUBAREA FLOW-LENGTH(FEET) =  1000.00
 ELEVATION DATA: UPSTREAM(FEET) =   4037.00  DOWNSTREAM(FEET) =   4007.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   15.563
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.395
 SUBAREA Tc AND LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 RESIDENTIAL
 ".4 DWELLING/ACRE"         B        3.42      0.42     0.900    76   15.56
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.900
 SUBAREA RUNOFF(CFS) =      9.28
 TOTAL AREA(ACRES) =      3.42   PEAK FLOW RATE(CFS) =      9.28

****************************************************************************
 FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) = 4007.00  DOWNSTREAM ELEVATION(FEET) = 3950.00
 STREET LENGTH(FEET) =  1954.00   CURB HEIGHT(INCHES) =  8.0
 STREET HALFWIDTH(FEET) = 40.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  30.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0250
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0250

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      36.11
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.59
   HALFSTREET FLOOD WIDTH(FEET) =   21.69
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.69
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.18
 STREET FLOW TRAVEL TIME(MIN.) =   8.83   Tc(MIN.) =   24.39
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.479
 SUBAREA LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 RESIDENTIAL
 ".4 DWELLING/ACRE"         B       27.87      0.42     0.900    76
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.900
 SUBAREA AREA(ACRES) =   27.87      SUBAREA RUNOFF(CFS) =   52.62
 EFFECTIVE AREA(ACRES) =     31.29    AREA-AVERAGED Fm(INCH/HR) =  0.38
 AREA-AVERAGED Fp(INCH/HR) =  0.42  AREA-AVERAGED Ap =  0.90
 TOTAL AREA(ACRES) =       31.3        PEAK FLOW RATE(CFS) =      59.08

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.68   HALFSTREET FLOOD WIDTH(FEET) =  27.10
 FLOW VELOCITY(FEET/SEC.) =  4.17   DEPTH*VELOCITY(FT*FT/SEC.) =   2.85
 *NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
        AND L = 1954.0 FT WITH ELEVATION-DROP =  57.0 FT, IS   60.8 CFS,
        WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE    102.00
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =    2954.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) = 3950.00  DOWNSTREAM ELEVATION(FEET) = 3874.00
  STREET LENGTH(FEET) =  2661.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 40.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  30.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0250
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0250

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     127.34
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.86
    HALFSTREET FLOOD WIDTH(FEET) =   44.56
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.77
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    4.09
  STREET FLOW TRAVEL TIME(MIN.) =   9.30   Tc(MIN.) =   33.69
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.977
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  ".4 DWELLING/ACRE"         B       94.36      0.42     0.900    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.900
  SUBAREA AREA(ACRES) =   94.36      SUBAREA RUNOFF(CFS) =  135.58
  EFFECTIVE AREA(ACRES) =    125.65    AREA-AVERAGED Fm(INCH/HR) =  0.38
  AREA-AVERAGED Fp(INCH/HR) =  0.42  AREA-AVERAGED Ap =  0.90
  TOTAL AREA(ACRES) =      125.7        PEAK FLOW RATE(CFS) =     180.54

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.95   HALFSTREET FLOOD WIDTH(FEET) =  53.47
  FLOW VELOCITY(FEET/SEC.) =  5.10   DEPTH*VELOCITY(FT*FT/SEC.) =   4.83
  *NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
         AND L = 2661.0 FT WITH ELEVATION-DROP =  76.0 FT, IS  185.4 CFS,
         WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE    103.00
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =    5615.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) = 3874.00  DOWNSTREAM ELEVATION(FEET) = 3837.00
  STREET LENGTH(FEET) =  1798.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 40.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  30.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
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  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0250
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0250

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     239.96
    ***STREET FLOWING FULL***
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  1.06
    HALFSTREET FLOOD WIDTH(FEET) =   59.68
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.97
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    5.27
  STREET FLOW TRAVEL TIME(MIN.) =   6.03   Tc(MIN.) =   39.72
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.762
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  ".4 DWELLING/ACRE"         B       95.47      0.42     0.900    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.900
  SUBAREA AREA(ACRES) =   95.47      SUBAREA RUNOFF(CFS) =  118.68
  EFFECTIVE AREA(ACRES) =    221.12    AREA-AVERAGED Fm(INCH/HR) =  0.38
  AREA-AVERAGED Fp(INCH/HR) =  0.42  AREA-AVERAGED Ap =  0.90
  TOTAL AREA(ACRES) =      221.1        PEAK FLOW RATE(CFS) =     274.88

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 1.10   HALFSTREET FLOOD WIDTH(FEET) =  61.63
  FLOW VELOCITY(FEET/SEC.) =  5.19   DEPTH*VELOCITY(FT*FT/SEC.) =   5.70
  *NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
         AND L = 1798.0 FT WITH ELEVATION-DROP =  37.0 FT, IS  202.1 CFS,
         WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE    104.00
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =    7413.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    105.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) = 3837.00  DOWNSTREAM ELEVATION(FEET) = 3804.00
  STREET LENGTH(FEET) =  1709.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 40.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  30.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0250
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0250

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     330.40
    ***STREET FLOWING FULL***
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  1.17
    HALFSTREET FLOOD WIDTH(FEET) =   65.05
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    5.36
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    6.26
  STREET FLOW TRAVEL TIME(MIN.) =   5.32   Tc(MIN.) =   45.03
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.614
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
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  RESIDENTIAL
  ".4 DWELLING/ACRE"         B      100.00      0.42     0.900    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.900
  SUBAREA AREA(ACRES) =  100.00      SUBAREA RUNOFF(CFS) =  110.96
  EFFECTIVE AREA(ACRES) =    321.12    AREA-AVERAGED Fm(INCH/HR) =  0.38
  AREA-AVERAGED Fp(INCH/HR) =  0.42  AREA-AVERAGED Ap =  0.90
  TOTAL AREA(ACRES) =      321.1        PEAK FLOW RATE(CFS) =     356.32

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 1.19   HALFSTREET FLOOD WIDTH(FEET) =  66.27
  FLOW VELOCITY(FEET/SEC.) =  5.49   DEPTH*VELOCITY(FT*FT/SEC.) =   6.55
  *NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
         AND L = 1709.0 FT WITH ELEVATION-DROP =  33.0 FT, IS  213.0 CFS,
         WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE    105.00
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    105.00 =    9122.00 FEET.

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  FLOW PROCESS FROM NODE    105.00 TO NODE    106.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) = 3804.00  DOWNSTREAM ELEVATION(FEET) = 3775.00
  STREET LENGTH(FEET) =  1584.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 40.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  30.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0250
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0250

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     400.78
    ***STREET FLOWING FULL***
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  1.24
    HALFSTREET FLOOD WIDTH(FEET) =   68.83
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    5.58
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    6.94
  STREET FLOW TRAVEL TIME(MIN.) =   4.73   Tc(MIN.) =   49.76
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.505
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  ".4 DWELLING/ACRE"         B       87.87      0.42     0.900    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.900
  SUBAREA AREA(ACRES) =   87.87      SUBAREA RUNOFF(CFS) =   88.89
  EFFECTIVE AREA(ACRES) =    408.99    AREA-AVERAGED Fm(INCH/HR) =  0.38
  AREA-AVERAGED Fp(INCH/HR) =  0.42  AREA-AVERAGED Ap =  0.90
  TOTAL AREA(ACRES) =      409.0        PEAK FLOW RATE(CFS) =     413.72

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 1.26   HALFSTREET FLOOD WIDTH(FEET) =  69.44
  FLOW VELOCITY(FEET/SEC.) =  5.63   DEPTH*VELOCITY(FT*FT/SEC.) =   7.07
  *NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
         AND L = 1584.0 FT WITH ELEVATION-DROP =  29.0 FT, IS  190.2 CFS,
         WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE    106.00
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 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    106.00 =   10706.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    106.00 TO NODE    107.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) = 3775.00  DOWNSTREAM ELEVATION(FEET) = 3744.00
 STREET LENGTH(FEET) =  1667.00   CURB HEIGHT(INCHES) =  8.0
 STREET HALFWIDTH(FEET) = 40.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  30.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0250
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0250

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     454.71
   ***STREET FLOWING FULL***
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  1.29
   HALFSTREET FLOOD WIDTH(FEET) =   71.03
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    5.83
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    7.51
 STREET FLOW TRAVEL TIME(MIN.) =   4.76   Tc(MIN.) =   54.53
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.411
 SUBAREA LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 RESIDENTIAL
 ".4 DWELLING/ACRE"          B       88.36      0.42     0.900    76
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.900
 SUBAREA AREA(ACRES) =   88.36      SUBAREA RUNOFF(CFS) =   81.97
 EFFECTIVE AREA(ACRES) =    497.35    AREA-AVERAGED Fm(INCH/HR) =  0.38
 AREA-AVERAGED Fp(INCH/HR) =  0.42  AREA-AVERAGED Ap =  0.90
 TOTAL AREA(ACRES) =      497.3        PEAK FLOW RATE(CFS) =     461.36

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 1.29   HALFSTREET FLOOD WIDTH(FEET) =  71.33
 FLOW VELOCITY(FEET/SEC.) =  5.85   DEPTH*VELOCITY(FT*FT/SEC.) =   7.57
 *NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
        AND L = 1667.0 FT WITH ELEVATION-DROP =  31.0 FT, IS  188.5 CFS,
        WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE    107.00
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    107.00 =   12373.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    107.00 TO NODE    108.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) = 3744.00  DOWNSTREAM ELEVATION(FEET) = 3706.00
 STREET LENGTH(FEET) =  1988.00   CURB HEIGHT(INCHES) =  8.0
 STREET HALFWIDTH(FEET) = 40.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  30.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020
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  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0250
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0250

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     492.90
    ***STREET FLOWING FULL***
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  1.31
    HALFSTREET FLOOD WIDTH(FEET) =   72.37
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    6.03
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    7.92
  STREET FLOW TRAVEL TIME(MIN.) =   5.50   Tc(MIN.) =   60.03
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.320
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  ".4 DWELLING/ACRE"         B       74.63      0.42     0.900    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.900
  SUBAREA AREA(ACRES) =   74.63      SUBAREA RUNOFF(CFS) =   63.06
  EFFECTIVE AREA(ACRES) =    571.98    AREA-AVERAGED Fm(INCH/HR) =  0.38
  AREA-AVERAGED Fp(INCH/HR) =  0.42  AREA-AVERAGED Ap =  0.90
  TOTAL AREA(ACRES) =      572.0        PEAK FLOW RATE(CFS) =     483.33

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 1.31   HALFSTREET FLOOD WIDTH(FEET) =  72.00
  FLOW VELOCITY(FEET/SEC.) =  5.99   DEPTH*VELOCITY(FT*FT/SEC.) =   7.82
  *NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
         AND L = 1988.0 FT WITH ELEVATION-DROP =  38.0 FT, IS  151.0 CFS,
         WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE    108.00
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    108.00 =   14361.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    108.00 TO NODE    109.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) = 3706.00  DOWNSTREAM ELEVATION(FEET) = 3675.00
  STREET LENGTH(FEET) =  2000.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 40.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  30.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0250
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0250

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     508.23
    ***STREET FLOWING FULL***
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  1.37
    HALFSTREET FLOOD WIDTH(FEET) =   75.18
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    5.64
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    7.73
  STREET FLOW TRAVEL TIME(MIN.) =   5.91   Tc(MIN.) =   65.93
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.236
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  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  ".4 DWELLING/ACRE"          B       64.71      0.42      0.900    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.900
  SUBAREA AREA(ACRES) =   64.71      SUBAREA RUNOFF(CFS) =   49.79
  EFFECTIVE AREA(ACRES) =    636.69    AREA-AVERAGED Fm(INCH/HR) =  0.38
  AREA-AVERAGED Fp(INCH/HR) =  0.42  AREA-AVERAGED Ap =  0.90
  TOTAL AREA(ACRES) =      636.7        PEAK FLOW RATE(CFS) =     489.91

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 1.35   HALFSTREET FLOOD WIDTH(FEET) =  74.39
  FLOW VELOCITY(FEET/SEC.) =  5.59   DEPTH*VELOCITY(FT*FT/SEC.) =   7.56
  *NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
         AND L = 2000.0 FT WITH ELEVATION-DROP =  31.0 FT, IS  126.3 CFS,
         WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE    109.00
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    109.00 =   16361.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    109.00 TO NODE    110.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) = 3675.00  DOWNSTREAM ELEVATION(FEET) = 3627.00
  STREET LENGTH(FEET) =  2974.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 40.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  30.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0250
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0250

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     524.26
    ***STREET FLOWING FULL***
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  1.37
    HALFSTREET FLOOD WIDTH(FEET) =   75.36
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    5.78
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    7.95
  STREET FLOW TRAVEL TIME(MIN.) =   8.57   Tc(MIN.) =   74.50
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.134
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "3-4 DWELLINGS/ACRE"        B       86.70      0.42      0.600    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA AREA(ACRES) =   86.70      SUBAREA RUNOFF(CFS) =   68.71
  EFFECTIVE AREA(ACRES) =    723.39    AREA-AVERAGED Fm(INCH/HR) =  0.37
  AREA-AVERAGED Fp(INCH/HR) =  0.42  AREA-AVERAGED Ap =  0.86
  TOTAL AREA(ACRES) =      723.4        PEAK FLOW RATE(CFS) =     500.58

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 1.35   HALFSTREET FLOOD WIDTH(FEET) =  74.39
  FLOW VELOCITY(FEET/SEC.) =  5.71   DEPTH*VELOCITY(FT*FT/SEC.) =   7.73
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  *NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
         AND L = 2974.0 FT WITH ELEVATION-DROP =  48.0 FT, IS  181.4 CFS,
         WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE    110.00
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    110.00 =   19335.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    111.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) = 3627.00  DOWNSTREAM ELEVATION(FEET) = 3604.00
  STREET LENGTH(FEET) =  1264.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 40.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  30.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0250
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0250

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     513.94
    ***STREET FLOWING FULL***
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  1.34
    HALFSTREET FLOOD WIDTH(FEET) =   73.71
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    6.00
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    8.04
  STREET FLOW TRAVEL TIME(MIN.) =   3.51   Tc(MIN.) =   78.02
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.098
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  ".4 DWELLING/ACRE"         B       41.38      0.42      0.900    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.900
  SUBAREA AREA(ACRES) =   41.38      SUBAREA RUNOFF(CFS) =   26.73
  EFFECTIVE AREA(ACRES) =    764.77    AREA-AVERAGED Fm(INCH/HR) =  0.37
  AREA-AVERAGED Fp(INCH/HR) =  0.42  AREA-AVERAGED Ap =  0.87
  TOTAL AREA(ACRES) =      764.8        PEAK FLOW RATE(CFS) =     503.86

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 1.33   HALFSTREET FLOOD WIDTH(FEET) =  73.29
  FLOW VELOCITY(FEET/SEC.) =  5.96   DEPTH*VELOCITY(FT*FT/SEC.) =   7.95
  *NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
         AND L = 1264.0 FT WITH ELEVATION-DROP =  23.0 FT, IS   96.2 CFS,
         WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE    111.00
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    111.00 =   20599.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    111.00 TO NODE    112.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) = 3604.00  DOWNSTREAM ELEVATION(FEET) = 3573.00
  STREET LENGTH(FEET) =  1348.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 40.00
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 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  30.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0250
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0250

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     516.38
   ***STREET FLOWING FULL***
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  1.30
   HALFSTREET FLOOD WIDTH(FEET) =   71.46
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    6.52
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    8.45
 STREET FLOW TRAVEL TIME(MIN.) =   3.44   Tc(MIN.) =   81.46
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.066
 SUBAREA LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 RESIDENTIAL
 ".4 DWELLING/ACRE"         B       40.64      0.42     0.900    76
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.900
 SUBAREA AREA(ACRES) =   40.64      SUBAREA RUNOFF(CFS) =   25.05
 EFFECTIVE AREA(ACRES) =    805.41    AREA-AVERAGED Fm(INCH/HR) =  0.37
 AREA-AVERAGED Fp(INCH/HR) =  0.42  AREA-AVERAGED Ap =  0.87
 TOTAL AREA(ACRES) =      805.4        PEAK FLOW RATE(CFS) =     506.39

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 1.29   HALFSTREET FLOOD WIDTH(FEET) =  71.09
 FLOW VELOCITY(FEET/SEC.) =  6.48   DEPTH*VELOCITY(FT*FT/SEC.) =   8.35
 *NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
        AND L = 1348.0 FT WITH ELEVATION-DROP =  31.0 FT, IS   96.1 CFS,
        WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE    112.00
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    112.00 =   21947.00 FEET.
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)     =      805.4  TC(MIN.) =     81.46
 EFFECTIVE AREA(ACRES) =    805.41  AREA-AVERAGED Fm(INCH/HR)=  0.37
 AREA-AVERAGED Fp(INCH/HR) =  0.42  AREA-AVERAGED Ap = 0.868
 PEAK FLOW RATE(CFS)   =     506.39
============================================================================
============================================================================
 END OF RATIONAL METHOD ANALYSIS
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DESCRIPTION OF STUDY:
ARROW ENGINEERING SERVICES JOB 12-6148
HESPERIA WEST (PV SOLAR PROJECT) 20 ACRES APN 0405-372-40
HYDROLOGY FLOWS FOR NODES 100-112

[SAN BERNARDINO COUNTY]

FILE NAME:6148HYD3.DAT *ENGLISH UNITS* CALCULATED BY:
TIME/DATE OF STUDY: 14:56 11/30/2012 CHECKED BY:
100.0-YEAR STORM RATIONAL METHOD STUDY (AMC III LOSSES) PAGE NUMBER 1 OF

[(c) 1983-2003 ADVANCED ENGINEERING SOFTWARE]

CONCENTRATION POINT NUMBER	AREA (ACRES) SUBAREA	AREA (ACRES) SUM	SOIL TYPE	DEV. TYPE	Tt MIN.	Tc MIN.	I (in/hr)	Fm (in/hr)	Fm (Avg)	Q-SUM (cfs)	PATH (ft)	SLOPE ft/ft	V FPS.	HYDRAULICS AND NOTES
											1000	.0300	..	INITIAL SUBAREA
101.00	3.4	3.4	B	2.5AC	..	15.6	3.39	0.38	0.381	9.3				
											1954	.0292	4.2	Qest.= 36.1
80.ft-STREET FLOW TO PT.# 102.00	27.9	31.29	B	2.5AC	8.8	24.4	2.48	0.38	0.381	59.1				D=0.59;D*V= 2.5 FLOODWIDTH=21.7
											2661	.0286	5.1	Qest.= 127.3
80.ft-STREET FLOW TO PT.# 103.00	94.4	125.65	B	2.5AC	9.3	33.7	1.98	0.38	0.381	180.5				D=0.86;D*V= 4.4 FLOODWIDTH=44.6
											1798	.0206	5.2	Qest.= 240.0
80.ft-STREET FLOW TO PT.# 104.00	95.5	221.12	B	2.5AC	6.0	39.7	1.76	0.38	0.381	274.9				D=1.06;D*V= 5.5 FLOODWIDTH=59.7
											1709	.0193	5.5	Qest.= 330.4
80.ft-STREET FLOW TO PT.# 105.00	100.0	321.12	B	2.5AC	5.3	45.0	1.61	0.38	0.381	356.3				D=1.17;D*V= 6.4 FLOODWIDTH=65.0
											1584	.0183	5.6	Qest.= 400.8
80.ft-STREET FLOW TO PT.# 106.00	87.9	408.99	B	2.5AC	4.7	49.8	1.50	0.38	0.381	413.7				D=1.24;D*V= 7.0 FLOODWIDTH=68.8
											1667	.0186	5.9	Qest.= 454.7
80.ft-STREET FLOW TO PT.# 107.00	88.4	497.35	B	2.5AC	4.8	54.5	1.41	0.38	0.381	461.4				D=1.29;D*V= 7.5 FLOODWIDTH=71.0
											1988	.0191	6.0	Qest.= 492.9
80.ft-STREET FLOW TO PT.# 108.00	74.6	571.98	B	2.5AC	5.5	60.0	1.32	0.38	0.381	483.3				D=1.31;D*V= 7.9 FLOODWIDTH=72.4
											2000	.0155	5.6	Qest.= 508.2
80.ft-STREET														D=1.37;D*V= 7.7

FLOW TO PT.#					5.9									FLOODWIDTH=75.2
109.00	64.7	636.69	B	2.5AC	----	65.9	1.24	0.38	0.381	489.9	----	-----	----	

DESCRIPTION OF STUDY:
ARROW ENGINEERING SERVICES JOB 12-6148
HESPERIA WEST (PV SOLAR PROJECT) 20 ACRES APN 0405-372-40
HYDROLOGY FLOWS FOR NODES 100-112

[SAN BERNARDINO COUNTY]

FILE NAME:6148HYD3.DAT *ENGLISH UNITS* CALCULATED BY:
TIME/DATE OF STUDY: 14:56 11/30/2012 CHECKED BY:
100.0-YEAR STORM RATIONAL METHOD STUDY (AMC III LOSSES) PAGE NUMBER 2 OF

[(c) 1983-2003 ADVANCED ENGINEERING SOFTWARE]

CONCENTRATION POINT NUMBER	AREA (ACRES) SUBAREA	AREA (ACRES) SUM	SOIL TYPE	DEV. TYPE	Tt MIN.	Tc MIN.	I (in/hr)	Fm (in/hr)	Fm (Avg)	Q-SUM (cfs)	PATH (ft)	SLOPE ft/ft	V FPS.	HYDRAULICS AND NOTES
											2974	.0161	5.7	Qest.= 524.3
80.ft-STREET														D=1.37;D*V= 7.8
FLOW TO PT.#					8.6									FLOODWIDTH=75.4
110.00	86.7	723.39	B	4D/AC	----	74.5	1.13	0.25	0.365	500.6	----	-----	----	
											1264	.0182	6.0	Qest.= 513.9
80.ft-STREET														D=1.34;D*V= 8.0
FLOW TO PT.#					3.5									FLOODWIDTH=73.7
111.00	41.4	764.77	B	2.5AC	----	78.0	1.10	0.38	0.366	503.9	----	-----	----	
											1348	.0230	6.5	Qest.= 516.4
80.ft-STREET														D=1.30;D*V= 8.4
FLOW TO PT.#					3.4									FLOODWIDTH=71.5
112.00	40.6	805	B	2.5AC	----	81.5	1.07	0.38	0.367	506.4	----	-----	----	
112.00		805			----	81.5				506	----	-----	----	STREAM SUMMARY

EFFECTIVE AREA = 805.41 Acres TOTAL AREA = 805.41 Acres PEAK FLOW RATE = 506.39 cfs
TIME OF CONCENTRATION(MIN.)= 81.46 MEAN VALUES: Fp = 0.423 (in/hr); Ap = 0.868; Fm = 0.367 (in/hr)

Search

Properties and Qualities Ratings

Open All | Close All

Soil Chemical Properties

- Calcium Carbonate (CaCO3)
- Cation-Exchange Capacity (CEC-7)
- Effective Cation-Exchange Capacity (ECEC)
- Electrical Conductivity (EC)
- Gypsum
- pH (1 to 1 Water)
- Sodium Adsorption Ratio (SAR)

Soil Erosion Factors

- K Factor, Rock Free
- K Factor, Whole Soil
- T Factor
- Wind Erodibility Group
- Wind Erodibility Index

Soil Physical Properties

- Available Water Capacity
- Available Water Supply, 0 to 100 cm
- Available Water Supply, 0 to 150 cm
- Available Water Supply, 0 to 25 cm
- Available Water Supply, 0 to 50 cm
- Bulk Density, 15 Bar
- Bulk Density, One-Tenth Bar
- Bulk Density, One-Third Bar
- Linear Extensibility
- Liquid Limit
- Organic Matter
- Percent Clay
- Percent Sand
- Percent Silt

Map — Hydrologic Soil Group

Scale (not to scale)

Warning: Soil Ratings Map may not be valid at this scale.

You have zoomed in beyond the scale at which the soil map for this area is intended to be used. Mapping of soils is done at a particular scale. The soil surveys that comprise your AOI were mapped at 1:24,000. The design of map units and the level of detail shown in the resulting soil map are dependent on that map scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Tables — Hydrologic Soil Group — Summary By Map Unit

Summary by Map Unit — San Bernardino County, California, Mojave River Area (CA671)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
134	HESPERIA LOAMY FINE SAND, 2 TO 5 PERCENT SLOPES	B	20.2	100.0%
Totals for Area of Interest			**20.2**	**100.0%**

Description — Hydrologic Soil Group

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have

Plasticity Index

Saturated Hydraulic Conductivity (Ksat)

Saturated Hydraulic Conductivity (Ksat), Standard Classes

Surface Texture

Water Content, 15 Bar

Water Content, One-Third Bar

Soil Qualities and Features

AASHTO Group Classification (Surface)

Depth to a Selected Soil Restrictive Layer

Depth to Any Soil Restrictive Layer

Drainage Class

Frost Action

Frost-Free Days

Hydrologic Soil Group

View Description | View Rating

View Options

Map

Table

Description of Rating

Rating Options

Detailed Description

Advanced Options

Aggregation Method: Dominant Condition

Component Percent Cutoff

Tie-break Rule: Lower / Higher

View Description | View Rating

Map Unit Name

Parent Material Name

Representative Slope

Unified Soil Classification (Surface)

Water Features

Depth to Water Table

Flooding Frequency Class

Ponding Frequency Class

a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options — Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

NOAA Atlas 14, Volume 6, Version 2
Location name: Hesperia, California, US*
Coordinates: 34.3914, -117.3617
Elevation: 3591ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval(years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.092 (0.076-0.112)	0.128 (0.106-0.156)	0.176 (0.145-0.216)	0.216 (0.176-0.267)	0.271 (0.214-0.346)	0.314 (0.243-0.409)	0.358 (0.271-0.479)	0.405 (0.297-0.557)	0.469 (0.331-0.673)	0.520 (0.354-0.772)
10-min	0.132 (0.109-0.161)	0.183 (0.152-0.224)	0.252 (0.208-0.309)	0.309 (0.253-0.382)	0.388 (0.307-0.496)	0.450 (0.348-0.587)	0.514 (0.388-0.687)	0.580 (0.426-0.798)	0.673 (0.474-0.964)	0.745 (0.507-1.11)
15-min	0.159 (0.132-0.194)	0.222 (0.183-0.271)	0.305 (0.252-0.374)	0.374 (0.306-0.462)	0.469 (0.371-0.599)	0.544 (0.421-0.710)	0.621 (0.469-0.831)	0.702 (0.516-0.965)	0.813 (0.573-1.17)	0.901 (0.613-1.34)
30-min	0.238 (0.197-0.290)	0.331 (0.274-0.405)	0.456 (0.376-0.558)	0.558 (0.457-0.690)	0.701 (0.554-0.895)	0.812 (0.629-1.06)	0.927 (0.701-1.24)	1.05 (0.770-1.44)	1.21 (0.855-1.74)	1.35 (0.916-2.00)
60-min	0.337 (0.279-0.412)	0.470 (0.388-0.574)	0.646 (0.533-0.791)	0.792 (0.648-0.978)	0.994 (0.786-1.27)	1.15 (0.892-1.50)	1.32 (0.994-1.76)	1.49 (1.09-2.04)	1.72 (1.21-2.47)	1.91 (1.30-2.83)
2-hr	0.498 (0.412-0.608)	0.667 (0.552-0.815)	0.895 (0.738-1.10)	1.08 (0.887-1.34)	1.35 (1.07-1.72)	1.56 (1.21-2.03)	1.78 (1.34-2.37)	2.01 (1.47-2.76)	2.32 (1.64-3.33)	2.58 (1.75-3.82)
3-hr	0.626 (0.518-0.764)	0.828 (0.685-1.01)	1.10 (0.907-1.35)	1.33 (1.09-1.64)	1.65 (1.30-2.11)	1.90 (1.47-2.48)	2.17 (1.64-2.90)	2.45 (1.80-3.36)	2.84 (2.00-4.07)	3.15 (2.14-4.68)
6-hr	0.895 (0.741-1.09)	1.17 (0.971-1.43)	1.55 (1.28-1.90)	1.87 (1.53-2.31)	2.32 (1.83-2.96)	2.67 (2.07-3.49)	3.05 (2.30-4.08)	3.45 (2.53-4.74)	4.01 (2.83-5.75)	4.47 (3.04-6.63)
12-hr	1.18 (0.973-1.43)	1.58 (1.30-1.93)	2.12 (1.75-2.60)	2.58 (2.11-3.18)	3.22 (2.54-4.11)	3.72 (2.88-4.86)	4.26 (3.22-5.69)	4.83 (3.55-6.64)	5.63 (3.97-8.07)	6.28 (4.27-9.31)
24-hr	1.58 (1.40-1.82)	2.18 (1.93-2.52)	3.00 (2.65-3.47)	3.68 (3.23-4.29)	4.64 (3.93-5.59)	5.41 (4.49-6.65)	6.21 (5.03-7.82)	7.06 (5.56-9.14)	8.26 (6.24-11.1)	9.23 (6.74-12.9)
2-day	1.85 (1.64-2.13)	2.58 (2.28-2.97)	3.57 (3.15-4.13)	4.42 (3.87-5.15)	5.62 (4.76-6.77)	6.59 (5.47-8.10)	7.62 (6.17-9.60)	8.73 (6.88-11.3)	10.3 (7.79-13.9)	11.6 (8.48-16.2)
3-day	1.98 (1.76-2.28)	2.77 (2.45-3.19)	3.86 (3.41-4.46)	4.79 (4.20-5.59)	6.13 (5.20-7.39)	7.23 (6.00-8.88)	8.39 (6.80-10.6)	9.66 (7.61-12.5)	11.5 (8.68-15.5)	13.0 (9.49-18.1)
4-day	2.13 (1.89-2.46)	2.99 (2.65-3.44)	4.17 (3.69-4.83)	5.19 (4.55-6.05)	6.66 (5.64-8.02)	7.86 (6.52-9.67)	9.15 (7.41-11.5)	10.5 (8.31-13.7)	12.6 (9.50-17.0)	14.2 (10.4-19.9)
7-day	2.39 (2.12-2.75)	3.35 (2.96-3.86)	4.67 (4.12-5.40)	5.81 (5.09-6.77)	7.45 (6.31-8.97)	8.79 (7.30-10.8)	10.2 (8.29-12.9)	11.8 (9.29-15.3)	14.0 (10.6-19.0)	15.9 (11.6-22.2)
10-day	2.56 (2.27-2.95)	3.58 (3.17-4.12)	4.99 (4.40-5.77)	6.20 (5.43-7.23)	7.95 (6.74-9.58)	9.38 (7.79-11.5)	10.9 (8.84-13.7)	12.6 (9.91-16.3)	15.0 (11.3-20.2)	17.0 (12.4-23.7)
20-day	3.05 (2.70-3.51)	4.28 (3.79-4.93)	5.98 (5.28-6.91)	7.45 (6.52-8.68)	9.56 (8.10-11.5)	11.3 (9.38-13.9)	13.2 (10.7-16.6)	15.2 (12.0-19.7)	18.1 (13.7-24.4)	20.5 (15.0-28.7)
30-day	3.59 (3.18-4.13)	5.02 (4.44-5.78)	7.00 (6.18-8.09)	8.72 (7.63-10.2)	11.2 (9.49-13.5)	13.2 (11.0-16.3)	15.4 (12.5-19.4)	17.8 (14.0-23.1)	21.3 (16.1-28.7)	24.1 (17.6-33.7)
45-day	4.28 (3.79-4.92)	5.92 (5.24-6.83)	8.22 (7.26-9.50)	10.2 (8.94-11.9)	13.1 (11.1-15.8)	15.5 (12.8-19.0)	18.0 (14.6-22.7)	20.8 (16.4-27.0)	24.9 (18.8-33.6)	28.3 (20.7-39.5)
60-day	4.90 (4.34-5.64)	6.69 (5.92-7.71)	9.18 (8.11-10.6)	11.3 (9.94-13.2)	14.5 (12.3-17.5)	17.1 (14.2-21.0)	19.9 (16.1-25.1)	23.0 (18.1-29.8)	27.5 (20.8-37.1)	31.3 (22.9-43.7)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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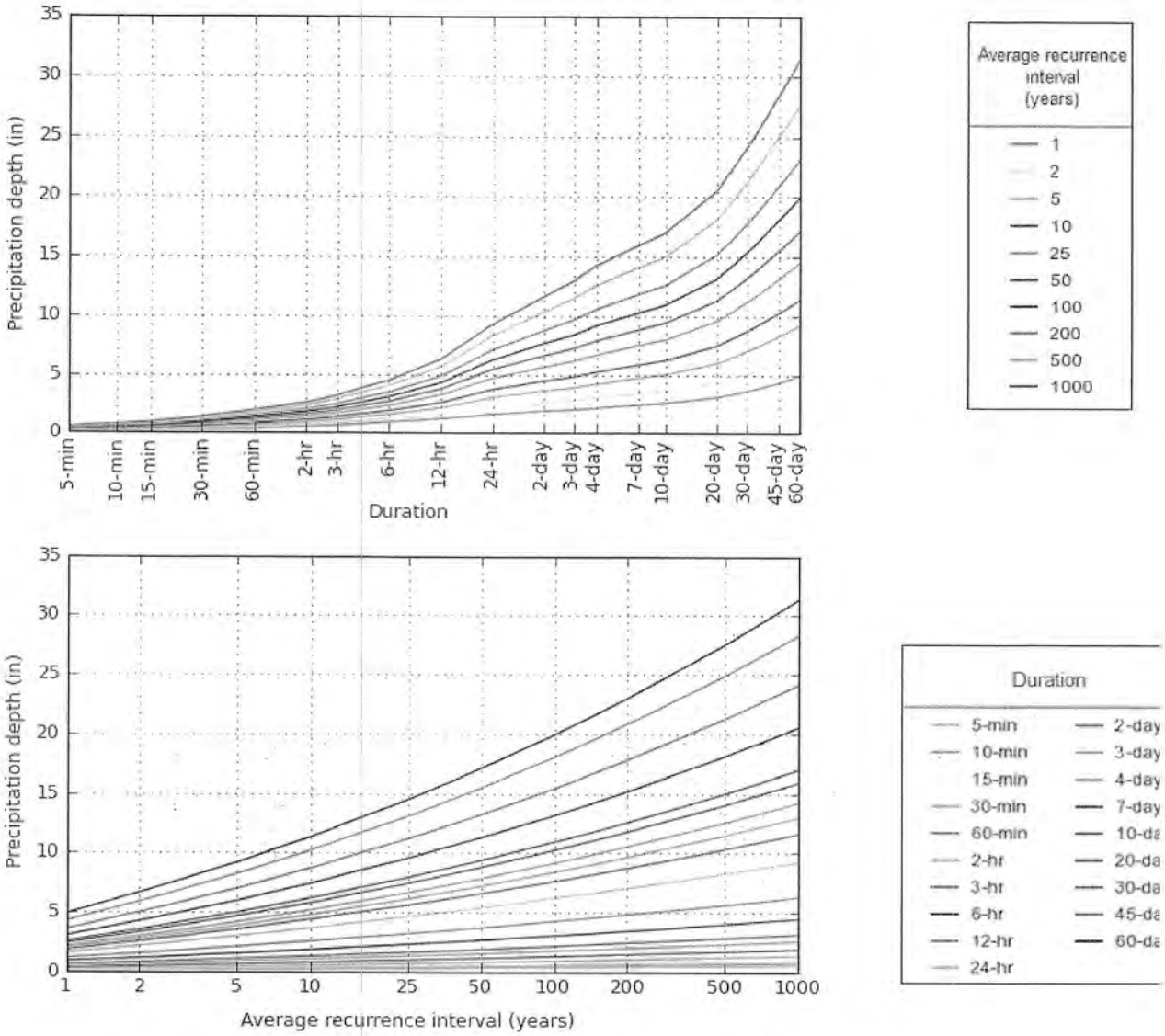
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Coordinates: 34.3914, -117.3617



NOAA/NWS/OHD/HDSC

Created (GMT): Thu Nov 29 16:41:58 2012

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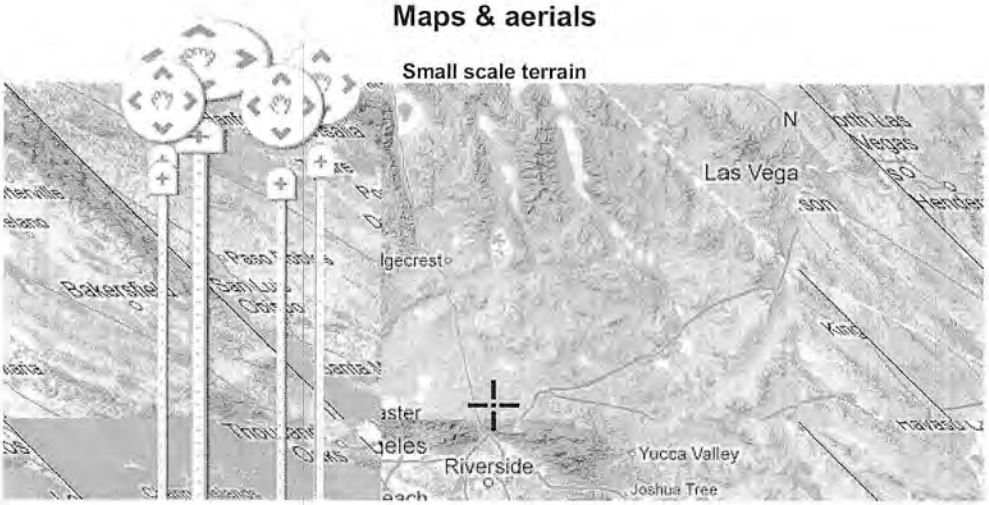
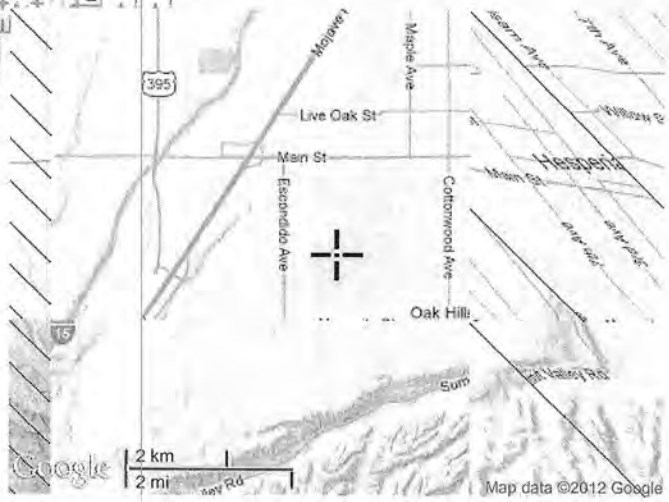
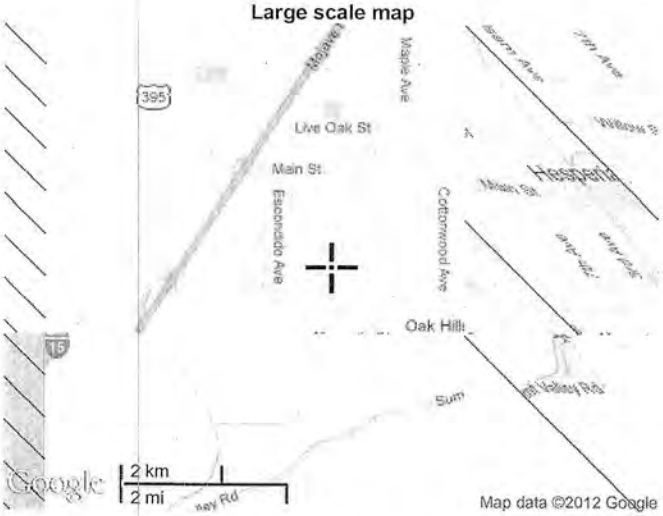
Maps & aerials

Small scale terrain

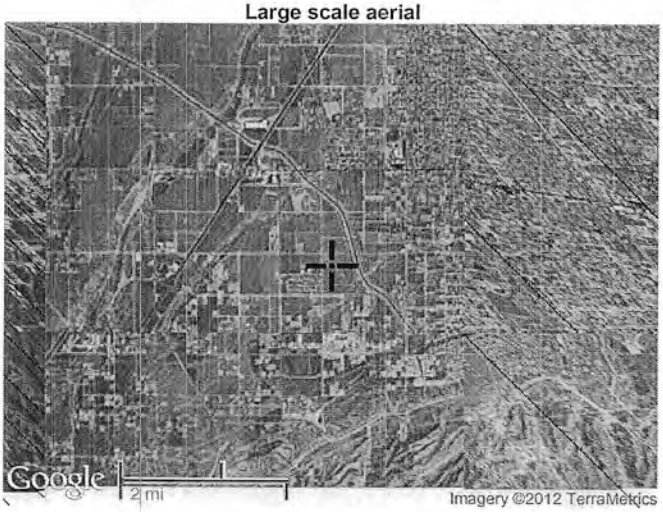




Large scale map



Large scale aerial



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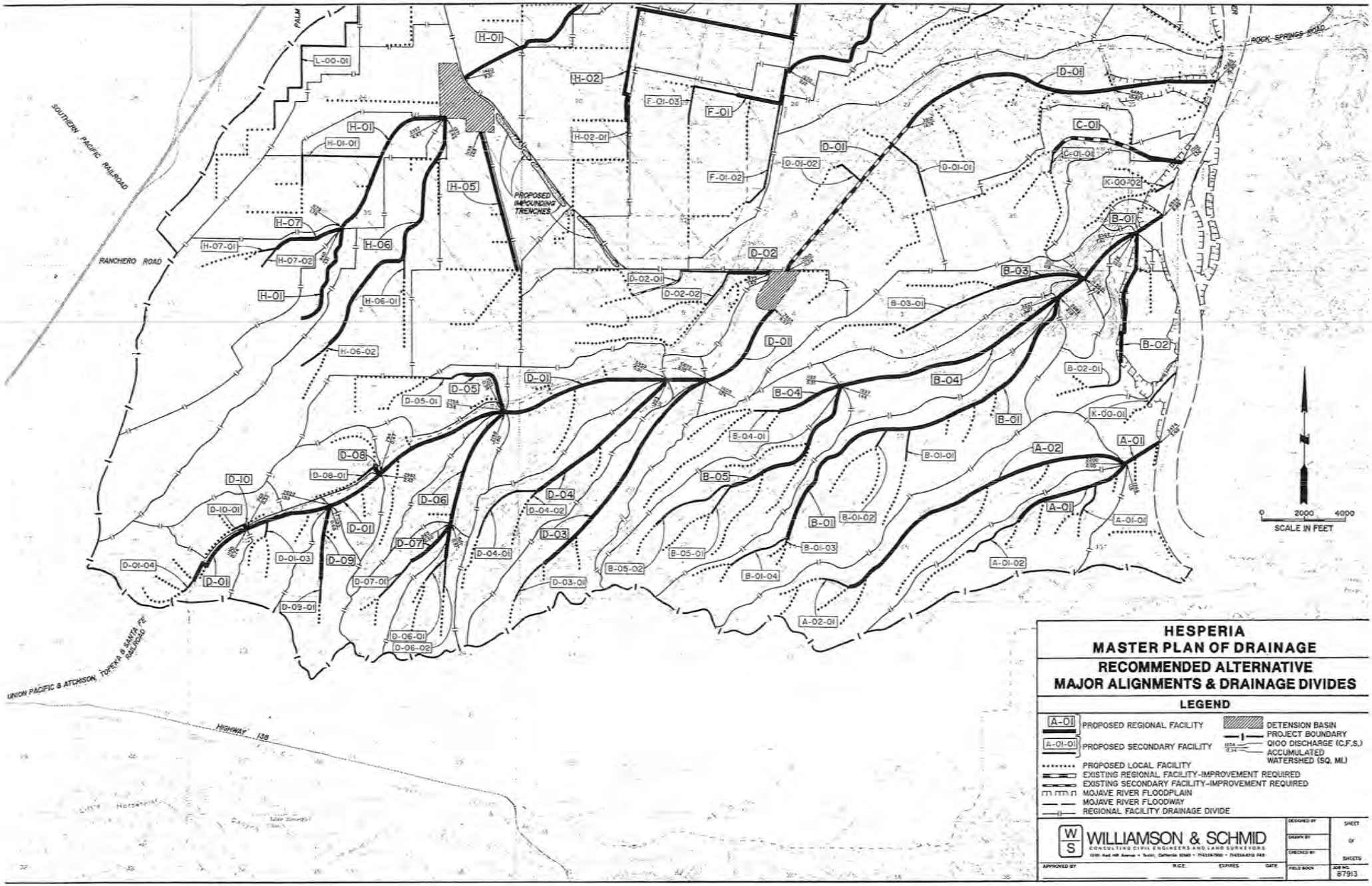
National Weather Service
Office of Hydrologic Development
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer



HESPERIA
MASTER PLAN OF DRAINAGE
RECOMMENDED ALTERNATIVE
MAJOR ALIGNMENTS & DRAINAGE DIVIDES

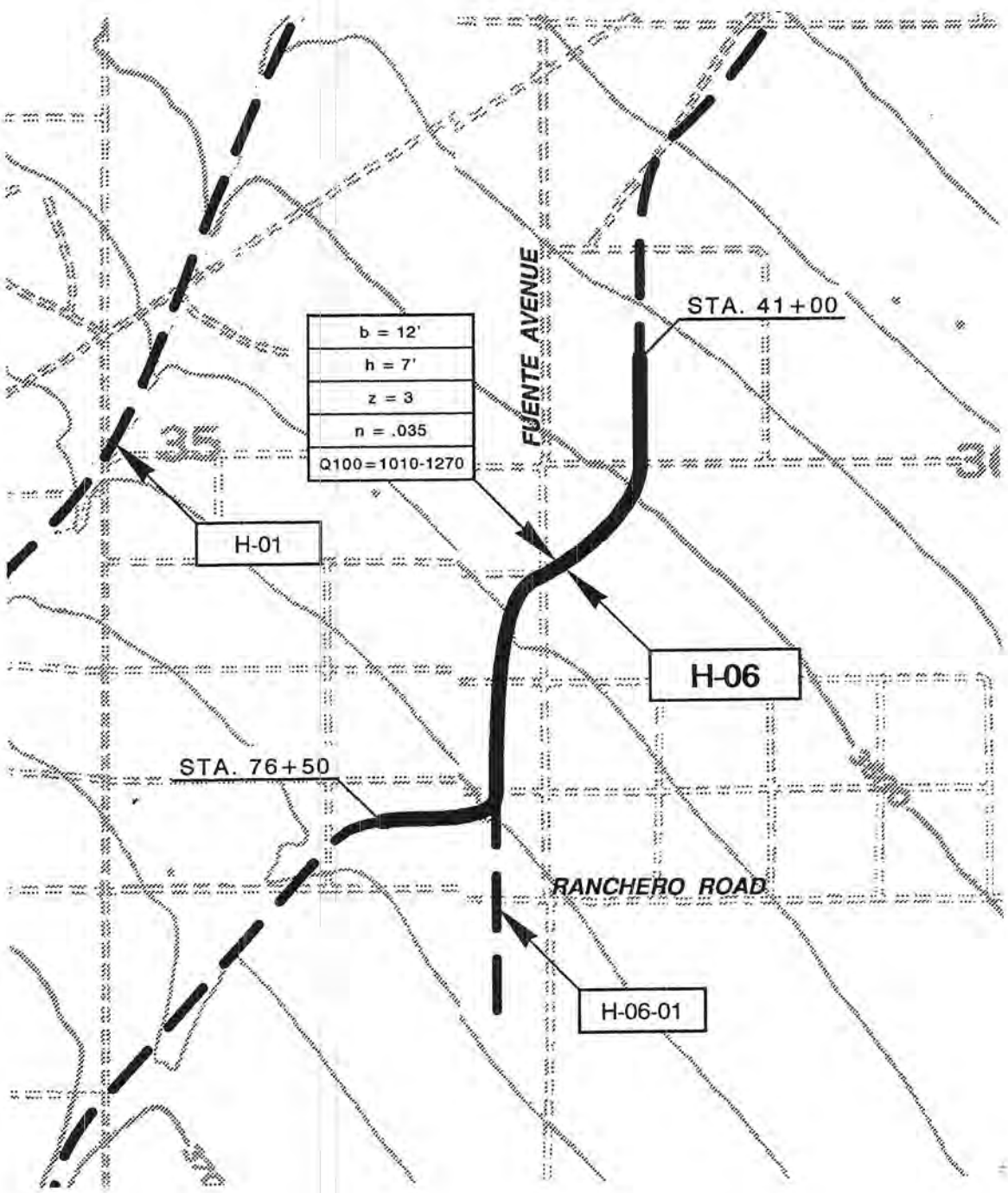
LEGEND

- A-01 — PROPOSED REGIONAL FACILITY
- A-01-01 — PROPOSED SECONDARY FACILITY
- PROPOSED LOCAL FACILITY
- EXISTING REGIONAL FACILITY-IMPROVEMENT REQUIRED
- EXISTING SECONDARY FACILITY-IMPROVEMENT REQUIRED
- MOJAVE RIVER FLOODPLAIN
- MOJAVE RIVER FLOODWAY
- REGIONAL FACILITY DRAINAGE DIVIDE
- DETENSION BASIN
- PROJECT BOUNDARY
- Q100 DISCHARGE (C.F.S.)
- ACCUMULATED WATERSHED (SQ. MI.)

WILLIAMSON & SCHMID
CONSULTING CIVIL ENGINEERS AND LAND SURVEYORS

DESIGNED BY | DRAWN BY | CHECKED BY | FIELD BOOK | SHEET | OF | SHEETS | JOB NO. 87913

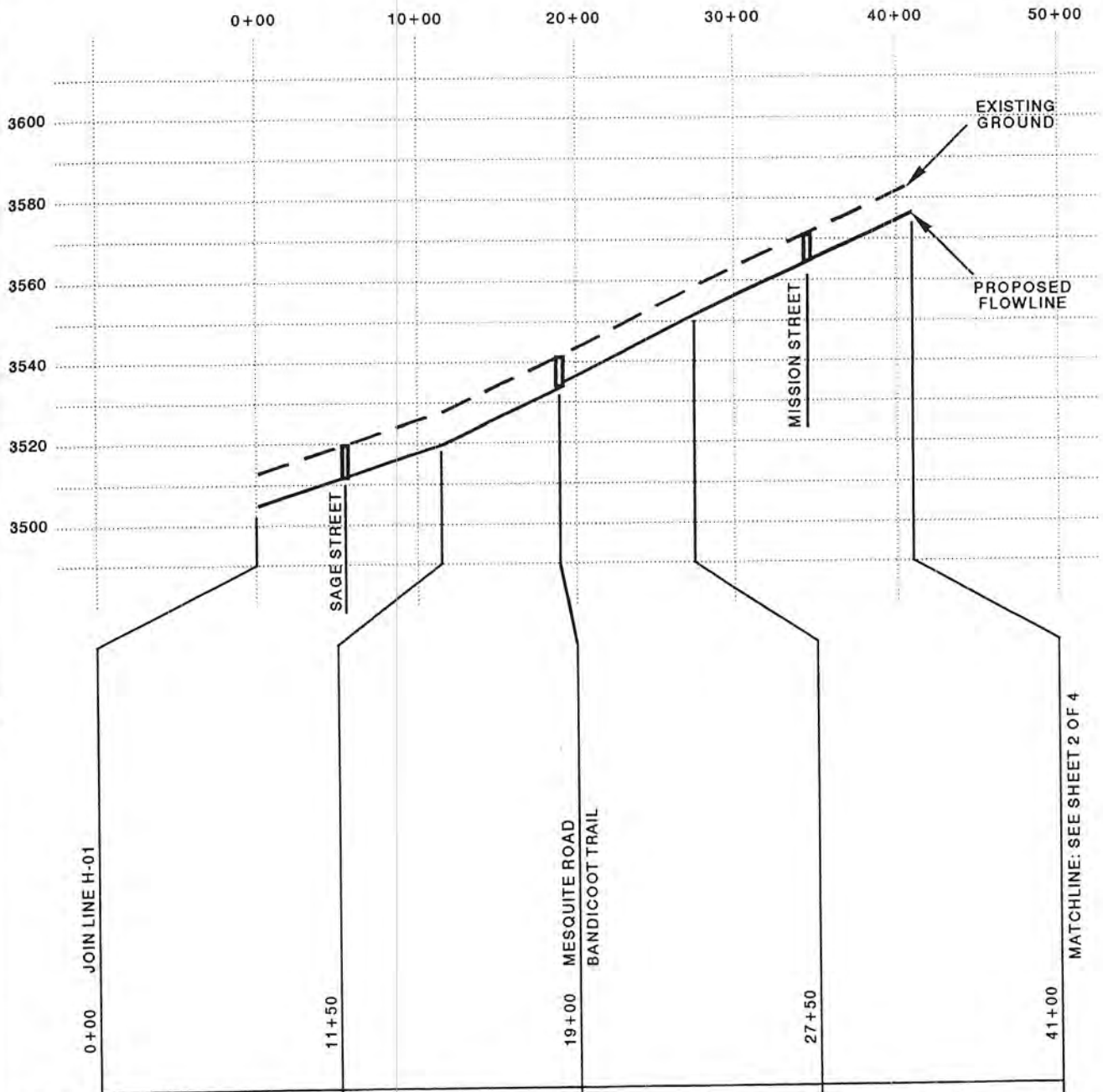
APPROVED BY | R.C.E. | EXPIRES | DATE



LEGEND

- PROPOSED FACILITY
- FACILITY SHOWN ELSEWHERE
- WATERSHED BOUNDARY
- FLOODPLAIN
- FLOODWAY
- DETENTION BASIN

MASTER PLAN OF DRAINAGE	HESPERIA H-06 SHEET 2 OF 4	WILLIAMSON & SCHMID W/S SCALE 1" = 1000' N



	0+00 to 11+50	11+50 to 19+00	19+00 to 27+50	27+50 to 41+00
LENGTH	1150	750	850	1350
SLOPE	.013	.019	.020	.019
FLOW	Q100 = 1370	Q100 = 1370	Q100 = 1270	Q100 = 1270
SIZE	b=12', h=8', z=3	b=12', h=8', z=3	b=12', h=7', z=3	b=12', h=7', z=3
FACILITY TYPE	RIPRAP	RIPRAP	RIPRAP	RIPRAP

LEGEND

BOX CULVERT ROAD CROSSING

BOTTOM CONTROL

TRAPEZOIDAL CHANNEL (h, b, z, 1)

REINFORCED CONCRETE BOX (RCB) (h, b)

REINFORCED CONCRETE PIPE (RCP) (SIZE)

MASTER PLAN OF DRAINAGE

HESPERIA
H-06
SHEET 1 OF 4

WILLIAMSON & SCHMID

W/S

SCALE
H: 1" = 1000'
V: 1" = 40'

Calculation for Weighted Average

Land use pervious percentage between nodes 109 and 110

Total Acres = 86.70	**% pervious**	**Product**
Acres RL = 55.70 AC	90	= 5013
Acres CN = 31 AC	10	= 310
		5323

$$\frac{5323}{86.70AC} = 61.4 \text{ pervious}$$

therefore use 60%

Ref: 12-6148
Hesperia West
Solar Project

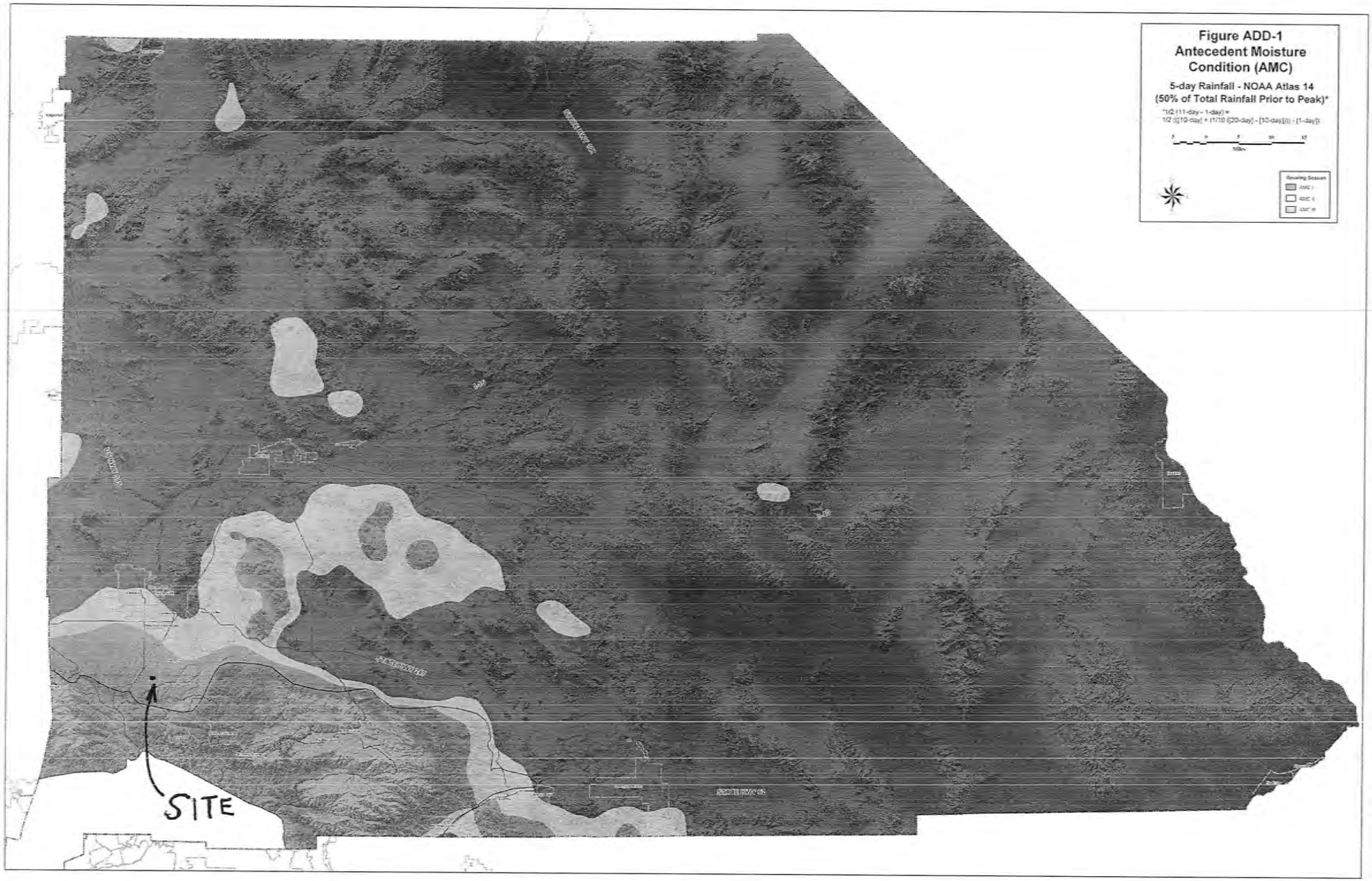
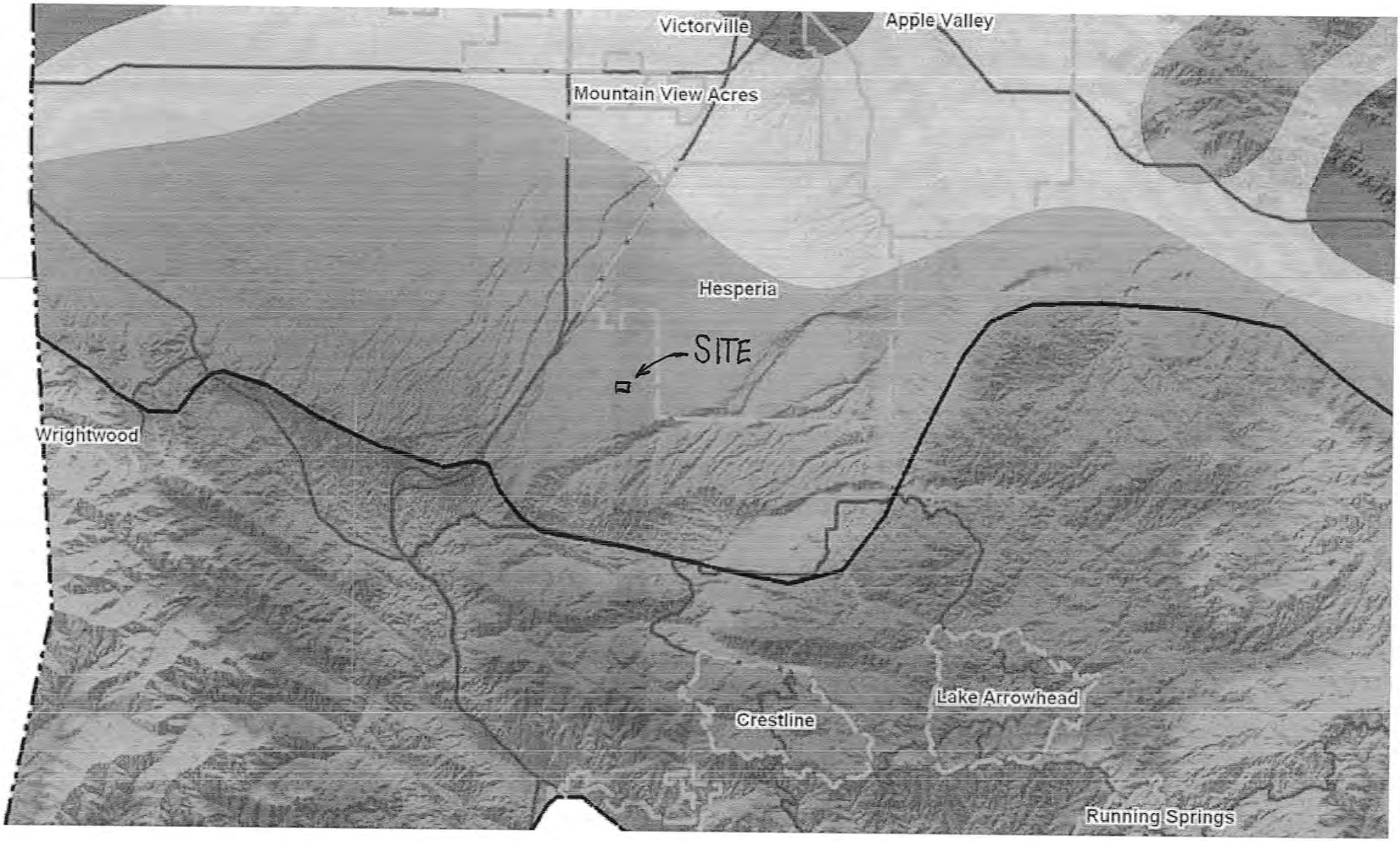


Figure ADD-1
Antecedent Moisture Condition (AMC)
5-day Rainfall - NOAA Atlas 14
(50% of Total Rainfall Prior to Peak)*
SITE


Victorville
Apple Valley
Mountain View Acres
Hesperia
SITE
Wrightwood
Lake Arrowhead
Crestline
Running Springs

Bandicoot - Node 112: 507cfs

Channel Calculator

Job 12-6148

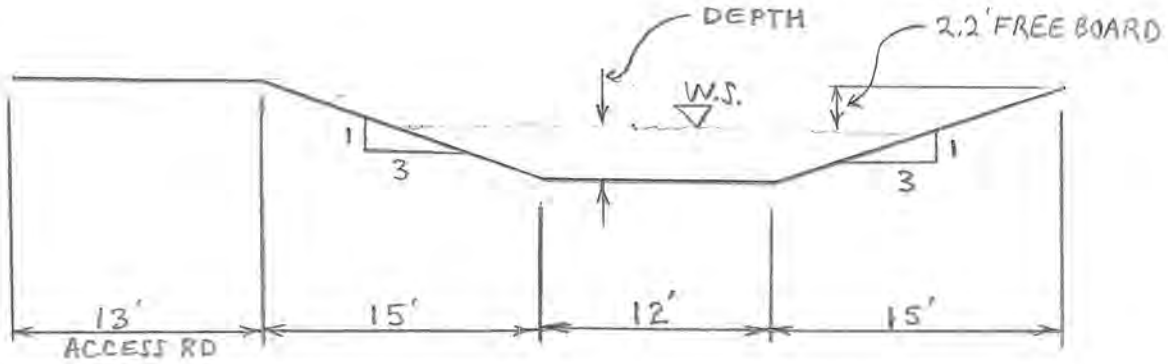
Given Input Data:

Shape	Trapezoidal
Solving for	Depth of Flow
Flowrate	570.0000 cfs
Slope	0.0230 ft/ft
Manning's n	0.0350
Height	5.0000 ft
Bottom width	12.0000 ft
Left slope	0.3300 ft/ft (V/H)
Right slope	0.3300 ft/ft (V/H)

Computed Results:

Depth	2.7986 ft
Velocity	9.9449 fps
Full Flowrate	1855.1394 cfs
Flow area	57.3160 ft2
Flow perimeter	29.8607 ft
Hydraulic radius	1.9194 ft
Top width	28.9610 ft
Area	135.7576 ft2
Perimeter	43.9104 ft
Percent full	55.9713 %

REF: HESPERIA WEST SOLAR PROJECT
APN 0405-372-40
S.B. COUNTY



CHANNEL 42'
ACCESS RD 13'
55' WIDTH NEEDED

100' WIDTH PROVIDED

Looking northerly down Fuente Avenue. Standing near the northwest corner of the property. This erosion illustrates a fairly large volume has flowed in this location recently.

Looking southerly down Fuente Avenue. Standing near the southwest corner of the property. This erosion illustrates a fairly large volume is flowing from the south and the west at this location.

Looking northerly down Fuente Avenue along the westerly project boundary. Standing near the southwest corner of the property.

Looking westerly down El Centro. Standing near the southwest corner of the property. Some water is entering Fuente from the west.

Looking southerly down the 84’ drainage easement from approximately the midpoint of the southern property line on El Centro Road. This erosion illustrates a fairly low volume has flowed in this location recently.

Looking northerly down Bandicoot along the easterly project boundary. Standing near the southeast corner of the property.